Modeling Trader Reputation Distribution

in An Online C2C Auction Market

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Zhangxi Lin
Department of ISQS
The Rawls College of Business Administration
Texas Tech University, TX 79409-2101
Tel: (806) 742-1926, Fax: (806) 742-3193
Email: zlin@ba.ttu.edu

Dahui Li
Department of ISQS
The Rawls College of Business Administration
Texas Tech University, TX 79409-2101
Tel: (806) 742-2397, Fax: (806) 742-3193
Email: dali@ttacs.ttu.edu

Wayne Huang
Department of MIS, College of Business
Ohio University, OH 47501
Tel: (740) 593-1801, Fax: (740) 593-9342
Email: huangw@ohio.edu

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Introduction

In the era of e-commerce, reputation becomes an important organization asset that is sensitive to organization's online performance due to world-wide exposures (Tadelis 1999). In an online C2C auction market an invisible guileful trader may easily defraud any trading partner to exploit more benefit and then changes his/her identity with little cost. As counterintuitive Internet frauds have been prevailing, more Internet users have been deterred from online trades because of increasing risk perception (Selis, Ramasastry and Wright 2001). In this situation trading partner's reputation becomes a critical signal to a trader in his/her decision-making. To promote safer online trades, eBay has offered the service of reputation feedback for its traders, which has resulted in fast growing businesses on eBay.com (Resnick and Zeckhauser 2001). A substantial amount of research work on eBay's reputation feedback system has been done since 1999. For example, Lee, Im and Lee (2000) investigate the effect of negative buyer feedback on auction price, and Resnick and Zeckhauser (2001) explore features of the reputation scoring system using a large set of reputation data from eBay.com. However, what economic implications are behind reputation score distribution and how the distribution affects online traders' risk decisions remain open questions. Based on those prior studies, this paper reports some preliminary research outcomes in this direction. The main objective of the research is to further examine the nature of reputation, including its measure, model building, and relationship with perceived risk and trust.

Reputation Score Distribution of Sellers on eBay.com

Resnick and Zeckhauser (2001) have a thorough examination of eBay's trading data, in which two histograms of the logarithm of scores, for buyers and sellers respectively, are presented. Both curves have a decreasing trend with a "bump-up" section before declining totally. We randomly collected 200 seller reputation scores from the eBay and draw a histogram as shown in Figure 1. The curve from our data demonstrates a decreasing trend with negligible "bump-ups".

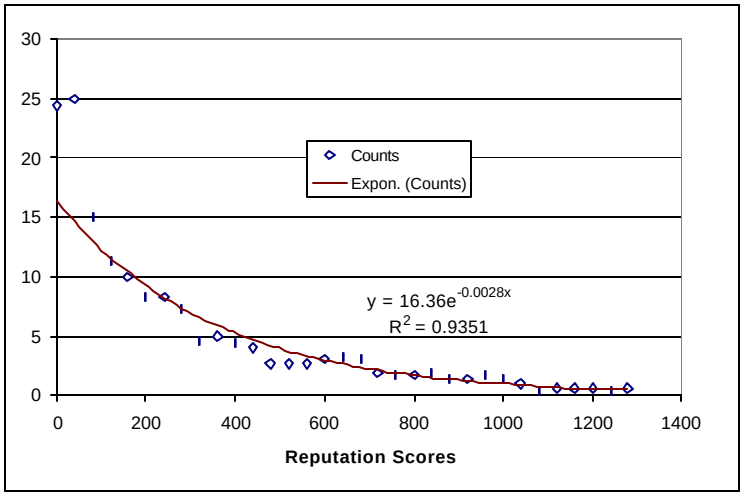

Figure 1. Histogram of reputation scores with a 2nd-order moving average

(Trader samples: 200 sellers, Source: eBay.com, Access Date: October 12, 2001)

A Stochastic Process Based Reputation Scoring Model and the Simulation Outcome

In this paper we propose a reputation-scoring model that is based on eBay's reputation system. Consider a simplified reputation scoring system when there is only a positive feedback record for a trader:

1) When a trader initially participates an online auction market his score is 0;
2) Each honest trading adds one to his score;
3) If the trader cheats his score is reset to 0; and
4) Assume that all traders have the same cheating probability.

This reputation scoring system can be modeled as a discrete-time Markov chain (Ross 1993).

Define a stochastic process $\{X_n, n = 0, 1, 2, \ldots\}$ that takes on a countable number of possible values. Denote $\{0, 1, 2, 3, \ldots\}$ the score state set, $\{p_0, p_1, p_2, \ldots\}$ the distribution of the score, and $q_i = P\{X_n = i | X_{n-1} = i - 1\}$ the probability the reputation score is reset, where $i > 0$ and $0 \ldots \leq q_{i-1} \leq q_i \leq \ldots \leq 1$.[1] Then:

$$p_0 = \frac{1}{1 + \sum_{i=1}^{\infty} (\prod_{j=1}^{i} q_j)} \text{ and } p_i = p_0 \prod_{j=1}^{i} q_j \,, \quad i = 1, 2, \ldots$$

If $q_i = q$, i.e., the probability that a trader cheats is irrelevant to the reputation score, when $n \to \infty$

$p_0 = 1 - q$ and $p_i = q^i(1 - q)$, $i = 1, 2, \ldots$

It clearly shows that $X = lim_{n \to \infty} X_n$ has a geometric distribution, the discrete form of exponential distribution.

The above reputation model has been tested in a C2C auction simulation system in this research. A computer-based system has been developed to simulate a whole process of C2C transaction. Frauds are randomly generated and traders are scored after each transaction according to their honest behaviors. Figure 2 is a histogram of reputation scores from 320 traders after running 200,000 trades using this system, which is in a

[1] Derived from Friedman and Resnick (1999), the higher the reputation score, the higher the cheating cost,

geometric distribution curve. An adjusted logarithm of reputation scores[2] having a linear-like decreasing curve further supports the distribution. The trend curve in Figure 2 matches with the one in Figure 1.

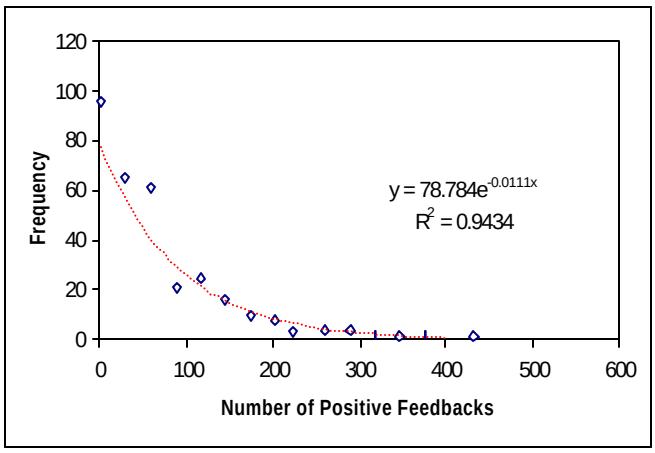

Figure 2. Histogram of reputation scores after 200,000 transactions

(Trader samples: 320 traders including buyers and sellers)

The finding in our research reveals the formation of the reputation score distribution. It will lead to further study in the game between traders of the honest and the dishonest.

Further Research

Our further research will focus on two aspects: first, a game-theory-based model will be proposed for traders with the reputation effect to study the relationship between the distribution of fraud rate and reputation distribution. Second, empirical studies will be conducted to further validate the research findings from behavioral perspectives.

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and the lower the probability a trader will cheat.

[2] The conversion formula is $x' = ln(x+1)$.

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